

## Appendix B: Worst-Case Draft Testing Procedures

### Frequency of Testing

#### Minimum Requirements: Regardless of Building Conditions or Size

Worst-case draft testing is required a minimum of three separate times during the course of every weatherization project.

1. Energy Audit
2. Final Day of Weatherization Installation Phase
3. Final Quality Control Inspection

In one circumstance only, worst-case draft testing can be performed just two times during the course of a weatherization project:

- ✓ A BPI Certified Quality Control Inspector is present on the project site during the final day of the weatherization installation phase. The certified inspector will perform final testing with the WAP installation team as they finish up a project and the certified inspector has not otherwise been involved in installing any weatherization measures during the course of the project.

*\*Note that conducting worst case draft testing is allowable and encouraged at the end of each day during the weatherization installation phase when installed measures are anticipated to have a significant airsealing benefit.*

#### Additional Requirements: Based on ACH50 Numbers

Daily worst-case draft testing is required based on the following ACH50 thresholds.

- ✓ **Site Built Homes** daily testing is required whenever the ACH50 is less than or equal to 5 ACH50.
- ✓ **Mobile homes (both single and double wide)** daily testing is required when the ACH50 is 10 or less.

#### Applicable Portions of Worst-Case Testing Procedures

Appliance Type	Measure Worst-Case CAZ Depressurization	Evaluate for Spillage	Measure Worst-Case Draft in Flue
Category 1 -Atmospheric Draft	Yes	Yes	Yes
Category 1 -Induced Draft	Yes	Yes	Yes
Category 3 -Positive Pressure -Non-Condensate	Yes	Yes	No
Category 4 -Positive Pressure -Produces Condensate	Yes	Yes	No



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### Spillage Evaluation Protocols

**A complete spillage evaluation must be completed for all heating systems and water heaters** unless the appliance burns a solid fuel, e.g., cord wood or pellets.

**Spillage shall be checked with smoke pencils, powder puffers, and/or mirrors.**

For appliances vented into a chimney, spillage shall be checked where the flue pipe connects into the chimney (*or chimney liner*), at every barometric damper/control, and at each diverter hood/box.

Acceptable Spillage Time Period		
Category 1-Atmospheric Draft & Category 1-Induced Draft	V.	Category 3 & Category 4
<b>If an appliance in this class spills flue gases at any of the locations listed on the previous page for a period longer than 60 seconds after startup it fails the spillage test.</b> A failed spillage test automatically means a failed draft test. However, a passing spillage test does not always mean an acceptable draft is present for a particular appliance. If the spillage test passes then test the draft inside the flue pipe.		These appliances have positive draft pressures and a spillage evaluation is conducted differently. Using a smoke pencil or powder puffer to test for spillage at every seam in the vent run is required. <b>No spillage for any period of time is acceptable for these types of appliances.</b> If any spillage exists corrective actions must be taken to eliminate all leaks in the vent run between the appliance and the building exterior.
<i>For more information on Spillage Evaluations refer to <b>Appendix A, Combustion Appliance Protocols</b></i>		



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### Testing Appliance Draft

#### Category 1: Atmospheric or Induced Draft Appliances

"In The Flue" Draft Testing Location  
by Venting Configuration & Fuel Type:

System Details	Minimum Distance: Test Hole to Elbow	Minimum Distance: Test Hole to Barometric Control**
Oil Fired	6"	NA
Oil Fired w/ barometric damper	6"	6"
Gas Fired w/ diverter (bell or box type)	6"	NA
Gas Fired w/ barometric control	6"	6"

*\*\*Whenever there is a barometric control the test hole shall be located at the appliance side of the barometric control, not on the chimney side of the barometric control.*

**Common Scenario:** An oil fired appliance equipped with an AFG Series Beckett burner & a barometric damper.

#### **FAQs About Draft Testing Locations For this Common Scenario:**

When is testing the strength of draft in the section of flue pipe located on the chimney side of a barometric control needed? Is it allowable?

**Guidance:** Drilling a draft test hole in the section of flue pipe on the chimney side of the barometric control is never required in this scenario. This draft test location could only be used in addition to the required spillage and draft testing location which is located on the appliance side of the barometric damper. It is allowable as a secondary testing location and could potentially be a valuable test to perform when trouble shooting a draft problem.

*For more detailed information on Combustion, Draft & Spillage Test Locations  
refer to Appendix A, Combustion Appliance Protocols*

**Do not drill holes in the flue pipe for appliances with positive draft pressures = Category 3 & 4.**



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### Establishing & Measuring Worst-Case Depressurization in the Combustion Appliance Zone (CAZ)

#### Step 1: Measure the Baseline Pressure

Set up the pressure gauge to measure the pressure difference between the combustion appliance zone (CAZ) and the outdoors. The gauge should be setup to read the CAZ pressure with reference to (WRT) outside pressure. The house should be set up with all windows and exterior doors closed, all exhaust appliances off, all combustion appliances off or in pilot mode, any fireplace dampers closed and all interior doors opened.

#### Step 2: Establish the Worst-Case Depressurization

The following guidelines are intended to assist weatherization staff establish worst-case depressurization in the CAZ so one can test the draft of a combustion appliance with confidence that the CAZ is set up in a true “worst-case” condition. The specific order of steps taken to get from the baseline condition into the worst-case condition can be done in more than one way. ***Remember, the ultimate goal is for you to find the worst-case scenario and then test the draft of the combustion appliances while the CAZ is in that “worst-case” condition.*** Doing this correctly could potentially save lives. Take your time and if you are not sure about the correct way to establish the worst-case in a particular situation please do not be shy to ask for assistance.

***When trying to get to worst-case depressurization watch your pressure gauge as you turn on any exhaust fans, clothes dryers, central vacuum systems and furnace air handlers. Continue to watch the gauge as you open and close interior doors.***

***Whatever combination of running appliances and door configurations creates the greatest negative pressure reading in the CAZ (WRT) is the Worst-Case Depressurization.***

**\*Always make sure that the dryer lint trap is clean or removed.**

**\*\*Always make sure that the furnace filter is clean or removed.**

*Guidelines for adequate draft levels of various combustion appliances are outlined on the following page, Appendix B: Page 5.*



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### Minimum Acceptable Worst-Case Draft

<b>Gas Appliances</b> (at various outdoor temperatures)					
Degrees F	<20	21-40	41-60	61-80	>80
Pascals	-5	-4	-3	-2	-1
Inches Water	-.02	-.016	-.012	-.008	-.004

*If the minimum acceptable worst case draft standards outlined here are not met then corrective actions must be taken.*

### Minimum Acceptable Worst-Case Draft

<b>Oil Appliances</b> (at various outdoor temperatures)					
Degrees F	<20	21-40	41-60	61-80	>80
Pascals		-5			-2.5
Inches Water		-.02			-.01

### Acceptable Worst Case Depressurization

*CAZ w/ reference to outside (general guidelines only)\**

Appliance Type	Depressurization Limit
Orphan gas hot water heater	-3 pascals
Atmospheric gas and oil furnace/ boiler	-5 pascals
Power-Vented appliance	-15 pascals
Direct-vent, sealed-combustion	-50 pascals

*\*Action is not required based on CAZ depressurization limits, but these numbers are sometimes indicative of when a back drafting issue will be more likely for a particular type of appliance.*



## Appendix B: Worst-Case Draft Testing Procedures

### Frequently Asked Questions

**Question:** If I turn on the dryer and all the exhaust fans and then test the appliance draft am I doing a worst case draft test correctly?

**Answer:** This is...

True /  False

...but why?

**Clarifying Example:** If an appliance—a fan, a dryer, etc.—is turned on and the CAZ pressure gets more positive, then any doors separating that appliance and the CAZ should be opened and closed. If that appliance is still making the CAZ more positive, with the door both opened and closed, then it should be turned off. The appliance is not contributing to worst-case depressurization and should not be running when the worst-case draft measurement is taken.

If an exhaust appliance makes the CAZ more negative, but only with an interior door in one position but not another, then the appliance should be left on and the door should be left in whichever position makes the CAZ go the most negative while the appliance is running.

**Question:** If a furnace air handler cannot be engaged with a button on the fan limit control do I still need to try and include the air handler in the worst case depressurization measurement?

**Answer:** Yes, but this is tricky and there are **three common scenarios** that require different approaches.

#### Scenario 1 of 3:

#### House w/ an oil or gas furnace & an electric water heater

*To test the worst case draft of the furnace:*

Turn up the T-stat to get the furnace to engage. Measure the draft in the flue after the burner turns on—with a cold chimney and before the air handler engages—and then measure the draft again immediately after the air handler engages. Document the lower of the two draft readings. Also monitor the CAZ depressurization while the furnace is running and determine if the CAZ goes more negative after the air handler kicks in. Document the largest negative number in the CAZ as the worst-case depressurization.

If the CAZ goes significantly more negative when the air handler turns on and/or the draft in the flue pipe gets significantly weaker check for leaky return ducts. It is possible for a furnace to back draft itself if the returns are leaky enough! This is one of many good reasons to seal the return side of the distribution system with duct mastic.



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### Frequently Asked Questions

*Question (from previous page): If a furnace air handler cannot be engaged with a button on the fan limit control do I still need to try and include the air handler in the worst case depressurization measurement?*

**Answer:** Yes, but this is tricky and there are **three common scenarios** that require different approaches.

**Scenario 2 of 3:**

**House w/ an oil or gas furnace & an oil or gas water heater vented into separate chimneys**

*To test the worst case draft of the furnace:*

Follow all of the steps listed previously in scenario 1.

*To test the worst case draft of the water heater:*

**If the CAZ was more negative with the furnace (*more specifically the air handler*) running during the furnace testing procedures then leave the furnace running while testing the water heater draft. Otherwise, turn the furnace off (*and wait for the air handler to shut off*) before testing the water heater draft.**

**Scenario 3 of 3:**

**House w/ an oil furnace and a gas water heater vented into a shared flue**

*To test the worst case draft of the furnace:* Follow all steps listed previously in scenario 1.

*To test the worst case draft of the water heater:*

Turn up the T-stat to get the furnace to engage. Wait for the air handler to engage. Monitor the CAZ depressurization while the furnace is running and determine if the CAZ goes more negative after the air handler kicks in. If the air handler does not make the CAZ more negative it is not contributing to worst case depressurization. Turn off the furnace, wait a few moments for the chimney to cool and then fire up the water heater and test the draft.

If the air handler does make the CAZ more negative it needs to be on when testing the draft of the water heater. This is counter intuitive because the furnace will have preheated the chimney which will likely strengthen the draft of the water heater that shares the same flue. Because of this, the timing for when to fire the water heater is important. Wait for the furnace to meet the T-stat setting in the home. This will shut off the burner but the air handler will continue to operate for a few minutes until shutting off on the low limit of the fan control. Allow the chimney to cool down as much as possible within the time frame allowed by the low limit setting of the fan control and then fire the water heater and test the draft. This will be the worst-case scenario for the water heater draft test; highest level of CAZ depressurization with the coolest chimney/flue temperature possible after the furnace's burner shuts off.

